

REMARKS

Claim 14 has been amended to specify that the instant polymers, when used in a semi-permeable filter membrane desalination system, inhibit calcium phosphate precipitation, improve salt rejection of the membrane, and do not affect system throughput. Support for this amendment may be seen in paragraph [0017] of the specification and in the Examples.

The Chen et al. '747 reference cited by the Examiner does not teach or suggest that the claimed polymers could effectively inhibit calcium phosphate deposition, improve salt rejection, and not adversely affect throughput of the membrane.

The Examiner cites to McNeel et al. as allegedly teaching that calcium phosphate inhibition and concurrent lack of adverse effects on salt rejection and system throughput are inherent properties of "cleaning or treatment of membranes using acrylic acid-containing formulations". McNeel indicates generally that the compositions therein disclosed control fouling "without substantially hindering and/or having detrimental effects on the separation membrane which include membrane fouling". The general reference to polyacrylic acid antiscalants at column 4, line 5 of McNeel et al. does not reasonably suggest to anyone the specific allyl ether functionality required by the copolymers set forth in independent claim 14. Stated simply, no one, after a reading of Chen et al. and McNeel et al., would find any teaching in these references that the specific copolymers set forth in that claim would fulfill the functional limitations of the claim. If the Examiner persists in his rejection, he is respectfully requested to point out specifically where McNeel et al. refers to any allyloxy functional copolymer and where this reference indicates that these copolymers can function to inhibit calcium phosphate inhibition, improve salt retention, and not adversely affect system throughput.

When a combination of references is alleged to render an invention "obvious", the prior art must be found (1) to have suggested the claimed invention to one of ordinary skill in the art, and the prior art must (2) reveal that those of ordinary skill in the art would have a reasonable expectation of success. Medichem, S.A. v. Rolabo, S.L., 437 F.3d 1157, 1164 (Fed. Cir. 2006). In the case at bar, a skilled artisan would not, after reading Chen et al. and McNeel et al., have

derived any suggestion that the specific allyloxy copolymers set forth in claim 14 could be used to inhibit calcium phosphate in filter membrane systems without adversely affecting salt rejection and system throughput. These references are also devoid of any suggestion that the specific allyloxy copolymers set forth in the claim would be reasonably expected to perform as claimed. As the Federal Circuit has indicated, a reasonable expectation of success means that one must be motivated to do more than merely “vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful”. *Id.* (citing *In re O’Farrell*, 853 F.2d 894, 903 (Fed. Cir. 1988)).

The patent to Amjad does nothing to remedy the deficient teaching of the above references. Amjad is not at all suggestive of the allyloxy functional copolymers as set forth in instant claim 14. Also, this patent does not teach calcium phosphate scale inhibition.

The Kessler et al. ‘755 reference is directed toward the inhibition of scale and corrosion in cooling water systems. There is no hint or suggestion in this reference directed toward utilization of the specific polymers now set forth in claim 14 in an RO membrane containing system wherein the treatment agent is effective in inhibiting calcium phosphate precipitation while not adversely affecting salt rejection. As the Examiner notes, an AA/AHPSE/PEGAE terpolymer is disclosed at column 6, line 49. This reference highlights the surprising nature of the invention in that the AA/AHPSE polymer preferred for use in conjunction with the ‘755 reference (see column 4, lines 32-33) performs quite poorly in the calcium phosphate inhibition tests reported graphically in Fig. 5 of the specification and discussed in paragraphs [0038] and [0045] of the specification. The AA/AHPSE copolymer includes allyloxy functionality similar to the specific copolymers set forth in independent claim 14 and dependent claims 12, 13, and 15. Accordingly, the failure of AA/AHPSE to perform well in the claimed environment to provide the claimed functional results convincingly demonstrates the unexpected, surprising results of the claimed invention.

Synthesis Example 11 of cited Publication 2003/0008793 A1 uses 3-allyoxy-1,2-propanediol as a precursor monomer in the preparation of acrylic acid/poly(ethylene glycol

/propylene glycol) allyl ether. The polymers are used as liquid detergents of the type used to launder fabrics and the like. No suggestion is found that these polymers can be used as calcium phosphate scale inhibitors in the claimed environment to provide the claimed functional limitations.

As further evidence of the unexpected results that are attendant upon use of the instant invention, the Examiner's kind attention is drawn to the attached Declaration of Dr. Adnan Mansour. As can be seen in Exhibits A and B attached to that Declaration, comparative tests were undertaken with regard to system throughput and salt retention characteristics. With regard to the latter, the AA/APES copolymer treatments, as claimed herein in instant claim 14, show marked improvement, especially as the elapsed time increases. This is important since, as Dr. Mansour indicates, even small improvements in salt retention are quite significant in commercial desalination systems. Indeed the DCA-222 treatment shown in Exhibit B performs poorly in comparison to the AA/APES treatment of the invention. The DCA-222 treatment has been conventionally used in reverse osmosis systems in the past. In contrast, the AA/APES treatment shows an increasingly positive trend in salt retention over elapsed time.

As can be further seen in connection with the salt retention tests referred to in Exhibit B, when compared to the H-MDC-150 phosphonate treatment set forth in McNeel et al., the tested, present AA/APES copolymer shows a clear upward trend thereover over a prolonged time period.

For all of the above reasons, it is respectfully submitted that all claims in the application are in proper form for allowance. Such action is accordingly solicited.


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The Examiner is invited to call the undersigned if, during the course of reconsideration of this application, any question or comment should arise.

Respectfully submitted,

WEGMAN, HESSLER & VANDERBURG

By 

Bruce E. Peacock
Reg. No. 28,457

Suite 200
6055 Rockside Woods Boulevard
Cleveland, Ohio 44131
216.642.3342

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